REMARKS

Rejections Under 35 USC §103

Claims 1-20 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. in view of either Nishino et al. (US Patent No. 5,739,205) or Litke (US Patent No. 4,533,422).

Claims 1-20 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. in view of Mikuni et al. (US Patent No. 5,175,337) and further in view of either Nishino et al. (US Patent No. 5,739,205) or Litke (US Patent No. 4,533,422).

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Claims 21-42 and 40-44 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. (US Patent No. 4,209,358) in view of Burnett et al. (US Patent No. 2,628,178) and Gruber et al (US Patent No. 3,987,019).

The rejections under 35 USC §103(a) are traversed for the reasons to follow. In the alternative, the rejections under 35 USC §103(a) have been overcome by the amendments to the claims.

Double Patenting Rejections

Claims 1-22 and 40-44 have been provisionally rejected under the judicially created doctrine of double patenting over copending application serial nos. 09/065,944 and 09/651,217.

In response to the double patenting rejections, two Terminal Disclaimers are attached to this Amendment. The Terminal Disclaimers disclaim the terminal portion of any patent granted on the present application, past the expiration date of any patents granted on application serial nos. 09/065,944 and 09/651,217.

Summary of the Invention

The pending claims are directed to a "method for packaging a semiconductor die to form a semiconductor package". As recited in claim 1, the method includes the steps of "providing a leadframe", and "providing a cyanoacrylate adhesive material formulated to cure in contact with the die in less than about 60 seconds in a temperature of about 20°C to 30°C and an ambient atmosphere".

Claim 1 also recites the steps of "providing a filler in the adhesive material selected to tailor a characteristic of the adhesive material in the package", "applying the adhesive material to the leadframe or the die", "placing the die on the leadframe with the adhesive material in contact with the die", and "curing the adhesive material in the temperature and the ambient atmosphere in less than about 60 seconds to bond the die to the leadframe".

Independent claim 6 is similar to claim 1 but states the leadframe comprises "a plurality of lead fingers". This type of leadframe (14A-Figure 5) is sometimes referred to as lead-on-chip leadframe. Claim 6 also recites the steps of "placing the die on the lead fingers with the

adhesive material compressed between the die and the lead fingers", and "wire bonding the die to the lead fingers".

Independent claim 12 is similar to claim 6 but states that the adhesive material comprises "an electrically insulating filler configured to increase a dielectric strength of the adhesive material".

Independent claim 15 is similar to claim 1 but recites a formula for the adhesive material, and also recites a "wire bonding" step.

Independent claim 21 is similar to claim 1 but recites that the adhesive material comprises an "anaerobic acrylic". Claim 21 also recites specific compounds for the filler, and a "wire bonding" step.

Independent claim 42 is similar to claim 6 but states that the adhesive material comprises either a "cyanoacrylate adhesive" or an "anaerobic acrylic".

Claims 1-22 and 40-44

DiLeo et al. has been cited as teaching bonding of a semiconductor device to a leadframe using a room temperature curing adhesive. Nishino et al. and Litke have been cited as teaching the incorporation of a filler in a cyanoacrylate adhesive. Mikuni et al. and O'Sullivan have been cited as teaching cyanoacrylate adhesive compositions. Burnett has been cited as teaching that aerobic curing acrylic monomers polymerize rapidly at room temperature and are used in a variety of applications. Gruber et al. has been cited as teaching the incorporation of a filler in an acrylate based anaerobic adhesive.

With respect to the above combination of references, Applicant submits that there is no incentive in the references, or in the art, to combine the references as required by MPEP and the case law. In this regard, all of the independent claims recite the step of providing a filler in the room-temperature instant-curing adhesive, or that the adhesive includes a filler. The primary reference

DiLeo et al. "teaches away" from the use of any fillers at column 2, lines 38-40. In addition, an electrically conductive filler would make the DiLeo et al. device inoperative as the P-N junctions would be adversely affected (column 2, lines 36-38). An electrically insulating filler would also make the DiLeo et al. device inoperative as the adhesive needs to provide "a low resistance, electrically conductive path between the components" (column 2, lines 54-55).

In addition, independent claims 6, 12, 15, 21 and 42 further distinguish the invention from the prior art as explained in the arguments to follow.

Claims 6-11, 21-22 and 40-41

Independent claim 6 has been amended to state that the cyanoacrylate adhesive material comprises "an electrically conductive filler". Similarly, independent claim 21 has been amended to recite specific metallic conductive fillers (Ag, Fe, Ni). Antecedent basis for these recitations is contained on page 8, line 34, to page 9, line 3 of the specification. The primary reference to DiLeo et al. "teaches away" from electrically conductive fillers at column 2, lines 31-41. With respect to the relationship of "teaching away" and unobviousness please note U.S. vs. Adams, 383 U.S. 39, 148 USPQ 479 (1966).

Further, an electrically conductive adhesive would make the DiLeo et al. device inoperative as "ions associated with the metallic particles therein migrate to the P-N junction 11 which seriously affects the operation of the device" (column 2, lines 36-38). The CCPA and the Federal Circuit have consistently held that when a 35 USC §103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the prima facie case of

obviousness can not be properly made. (See for example, In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984.))

Claims 12-14

Independent claim 12 includes the recitation that the "cyanoacrylate adhesive" includes "an electrically insulating filler configured to increase a dielectric strength of the adhesive material". Such an electrically insulating filler would also make the DiLeo et al. device inoperative as a current must pass through the epoxy adhesive 31 to operate the LED 10. Specifically, as stated at column 2, lines 48-56 of DiLeo et al.: "Although the mechanism is not fully understood, it appears that the clamping force used to bond the components causes the non-conductive adhesive to be moved into the interstices between the high points on the surfaces of both components permitting the high points to touch or to be in close proximity to provide a low resistance, electrically conductive path between the components. A current of approximately 10 milliamps passes through the bonded LED 10."

An electrically insulating filler in the adhesive 31 would prevent the passage of current through the adhesive, and would also prevent the LED 10 and the cups 23 from touching. As argued above, when a 35 USC §103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the prima facie case of obviousness can not be properly made.

Claims 15-20

Independent claim 15 recites the steps of "applying a catalyst to the leadframe or to the die" and "curing the adhesive layer ..... by interaction of the adhesive material with the catalyst to bond the die to the

leadframe". A catalyst on the device or the leadframe would make the DiLeo et al. device inoperative.

In particular, as stated at column 2, line 57 to column 3, line 2 of DiLeo et al.: "It shold be emphasized that the surface of the components to be joined with the unfilled epoxy must be substantially free of insulating films oxides or the like. Such contaminant-free surfaces are preserved for the lifetime of the assembly in the present invention by coating the surfaces with a thin layer of gold. Although gold has been found to be most effective, any other noble metal may be used. Additionally, other techniques such as cleaning the components, bonding and use of the assembly in an environment where deleterious films, oxides or the like would be prevented or placing additives in the non-conducting adhesive to remove and prevent the formation of the undesirable film at the bond site may be used."

As argued above, a prima facie case of obviousness cannot be established by a modification to a reference that destroys the function of the invention therein. In addition, the above cited passage would tend to "teach away" from the use of a catalyst such that there would be no incentive to combine DiLeo et al. with a reference such as Nishino et al. or Litke in which a catalyst is employed.

Claims 42-44

Independent claim 42 recites the step of "providing a lead-on-chip leadframe comprising a plurality of lead fingers configured to support the die and comprising a plurality of bonding sites". Claim 42 also recites the steps of "placing the die on the leadframe with the adhesive material in contact with the die and the lead fingers to form an adhesive layer therebetween", and "curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond

the die to the lead fingers. Claim 42 also recites the step of "wire bonding the die to the bonding sites".

The cited combination of art does not disclose the above recited steps of bonding a semiconductor die to a lead-on-chip leadframe using an adhesive formulated to cure at room temperature in less than sixty second, and then wire bonding the die to the lead fingers. Although DiLeo et al. employs a leadframe it is not a lead-on-chip leadframe. In addition, the leads 24 in DiLeo et al. are attached using the adhesive 31 (column 3, lines 25-30) rather than by wire bonding.

Applicant would submit that the claimed method for forming a lead-on-chip semiconductor package is novel and unobvious over the art.

Conclusion

In view of the above arguments, favorable consideration and allowance of claims 1-22, and 40-44 is requested. A Petition For Extension Of Time (30 day) is also being filed with this Amendment. Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

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MARKED VERSION OF AMENDED CLAIMS SHOWING CHANGES

6. (seven times amended) A method for packaging a semiconductor die to form a semiconductor package comprising:

providing a leadframe comprising a plurality of lead fingers;

providing a cyanoacrylate adhesive material formulated to cure in contact with the die in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere, the adhesive material comprising an electrically conductive filler;

[providing a filler in the adhesive material selected to tailor a characteristic of the adhesive material in the package;]

applying the adhesive material to the lead fingers or to the die;

placing the die on the lead fingers with the adhesive material compressed between the die and the lead fingers to form an adhesive layer therebetween;

curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond the die to the lead fingers;

wire bonding the die to the lead fingers; and

encapsulating the die.

10. (four times amended) The method of claim 6 wherein the electrically conductive filler comprises a material selected from the group consisting of Ag, Ni and Fe.

[SiO_2.]

12. (seven times amended) A method for packaging a semiconductor die to form a semiconductor package, comprising:

providing a leadframe comprising a plurality of lead fingers;

applying an adhesive material on the lead fingers or on the die, the adhesive material comprising a cyanoacrylate adhesive formulated to cure in contact with the die in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere, and an electrically insulating filler;

[configured to increase a dielectric strength of the adhesive material;]

placing the die on the lead fingers with the adhesive material in contact with the die and the lead fingers to form an adhesive layer therebetween; and

curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond the die to the lead fingers.

[;]

[wire bonding the die to the lead fingers; and]

[encapsulating the die.]

21. (seven times amended) A method for packaging a semiconductor die to form a semiconductor package comprising:

providing a leadframe;

providing an adhesive material comprising an anaerobic acrylic formulated to cure in contact with the die in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere;

providing a filler in the adhesive material comprising a material selected from the group consisting of [SiO_2, Al_2O_3, AlN,] Ag, [Ni,] Fe [, SiC,] and [polystyrene coated] Ni;

applying the adhesive material to the leadframe or to the die;

placing the die on the leadframe with the adhesive material compressed between the die and the leadframe to form an adhesive layer therebetween; and

curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond the die to the leadframe.

[;]

[wire bonding the die to the lead frame; and]

[encapsulating the die.]

42. (six times amended) A method for packaging a semiconductor die to form a semiconductor package, comprising:

providing a lead-on-chip leadframe comprising a plurality of lead fingers configured to support the die and comprising a plurality of bonding sites;

providing an adhesive material comprising a cyanoacrylate adhesive or an anaerobic acrylic formulated to cure in contact with the die in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere;

providing a filler in the adhesive material selected to tailor a characteristic of the adhesive material in the package;

applying the adhesive material to the die or to the leadframe;

placing the die on the leadframe with the adhesive material in contact with the die and the [leadframe] lead fingers to form an adhesive layer therebetween;

curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond the die to the [leadframe] lead fingers;

wire bonding the die to the bonding sites; and

encapsulating the die and at least portions of the lead fingers.

43. (thrice amended) The method of claim 42 wherein the filler comprises an electrically insulating material.

[leadframe comprises a lead-on-chip leadframe.]

44. (twice amended) The method of claim 42 wherein the filler comprises an electrically conductive material. [SiO_2.]

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8

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September 16, 2002
Date of Signature

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